Northumbria University NEWCASTLE

The Fram2 space rocket before launch

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Northumbria University receives further funding after testing Blood Flow Restriction (BFR) technology in orbit

Equipment developed by researchers at Northumbria University, in collaboration with key industry partners, to improve the health and fitness of astronauts has received further research funding after being used in space for the first time.

The UK Space Agency has awarded £287,000 to the University to undertake further research into the use of Blood Flow Restriction (BFR) exercise and

associated hardware technology, *the Personalised Tourniquet System for Spaceflight (PTSS)*, in a microgravity environment, expanding the frontiers of rehabilitation and strength training beyond Earth.

BFR is a technique that allows individuals to exercise using lower intensities while still achieving significant strength and muscle gains, thus providing a means of improving training efficiency when there are physical and environmental constraints upon the use of exercise.

By temporarily and precisely restricting blood flow to a limb using a pneumatic tourniquet cuff, BFR activates muscle growth and strength improvements in ways typically only triggered during higher intensity exercise. As such, it is known to be especially useful in physical rehabilitation and athletic training, and researchers have been examining how the technique can be used in space health. As astronauts lose strength and muscle mass rapidly while on space missions because of the absence of gravity, BFR offers a promising method to preserve musculoskeletal health with minimal equipment and time commitment.

Dr Luke Hughes from Northumbria's Aerospace Medicine and Rehabilitation Laboratory has been at the forefront of BFR research for almost a decade and played a central role in advancing the scientific and operational readiness of this project for space deployment. He has, with key collaborators, developed an innovative device that meets the constraints of space travel and enables BFR exercises to be performed during spaceflight.

The SpaceX Fram2 mission, which launched earlier this year, carried Northumbria’s PTSS BFR exercise device as part of a research initiative studying countermeasures to protect crew health and performance in space.

The device had been adapted and made space ready by Dr Hughes and his team at Northumbria, using equipment from world-leaders in automatic tourniquet technology, Vancouver-based Delfi Medical Innovations. Delfi’s PTS is the gold-standard equipment used to perform BFR exercise here on Earth using automatic, personalised prescription and accurate, surgical-grade autoregulation of BFR pressure to ensure the safety and effectiveness of the BFR stimulus. Delfi's PTS for BFR involves applying a surgical-grade tourniquet cuff to an individual's limb and inflating it to compress the limb and underlying vasculature, to safely reduce blood flow and oxygen supply to muscle and bone tissues during exercise.

Following on from the success of the mission, Dr Hughes' research project has now received £287,000 worth of funding from the UK Space Agency (UKSA) as part of a batch of 23 projects the UKSA has funded to strengthen international space partnerships, develop national capabilities and boost economic growth.

This project, working with Western Clinical Engineering Group, Delfi Medical Innovations, the Canadian Space Agency, European Space Agency and NASA, aims to improve astronaut health on missions beyond low Earth orbit by further developing and optimising BFR exercise with the associated PTSS. Western Clinical Engineering Group are supporting this programme of research by developing an adapted version of the PTSS to resolve technological uncertainties related to future space applications. Building on the recent study evaluating BFR exercise in orbit, this new project will resolve technological uncertainties to integrate biofeedback technology into the space-qualified hardware for real-time monitoring and optimisation of the BFR exercise stimulus in space.

Dr Hughes said: “BFR exercise is at the forefront of innovative technologies to optimise exercise countermeasures to protect crew health and performance during spaceflight missions where constraints upon the use of exercise are anticipated. It’s fantastic to see the success of our previous projects recognised with this award of further funding to progress our programme of research.”

Dr James McEwen OC OBC, President of Western Clinical Engineering Group, said: “We are delighted to be working with Dr Hughes and his team to resolve technological uncertainties in order to develop an innovative PTSS system optimised for his planned research.”

Dr Paul Bate, Chief Executive of the UK Space Agency, said: “These new projects span the full spectrum of UK space expertise, from telecommunications, propulsion and environmental monitoring to cutting-edge technologies that could change how we develop treatments for deadly diseases using microgravity. By combining home-grown talent with global expertise, we want to strengthen our capabilities, support growth, and ensure the UK remains at the forefront of space innovation.”

Northumbria University is powering the next generation of space innovation, working across a multitude of specialist areas, from space physiology and

solar and space physics to satellite communications and space law and policy.

Northumbria collaborates extensively with partners including UK Research and Innovation, the UK Space Agency, the UK Met Office, and over 40 other industrial partners.

In 2023, the University announced the development of the new North East Space Skills and Technology Centre (NESST), which is expected to open in 2026.

Described as a “game-changer” for the UK space economy, NESST is the result of a £50 million investment with partners including the UK Space Agency and Lockheed Martin UK Space. The Centre will bring together industry and academia to collaborate on internationally significant space research and technological developments, creating over 350 jobs and injecting over £260 million into the North East economy over the next 30 years.

UNIVERSITY OF THE YEAR 2022 (Times Higher Education Awards)

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